Cochlear Implants: a tips & reference guide for teachers working with students using CIs

Master's Project

Submitted to the Faculty
Of the Master of Science Program in Secondary Education
Of Students who are Deaf or Hard of Hearing

National Technical Institute for the Deaf
ROCHESTER INSTITUTE OF TECHNOLOGY

By

Thomas J. Ohl

In Partial Fulfillment of the Requirements
For the Degree of Master of Science

Rochester, New York June 12, 2003

Approved: _____
(Project Advisor)

_____
(Project Advisor)

_____
(Program Director)

Cochlear Implants:

a tips & reference guide for teachers working with students using CIs

Acknowledgements

This booklet is a product of collaboration with persons whose understanding of the subject far exceeded my own. To this end, the author would like to thank Josara Wallber and Don Sims for their valuable input, time, and guidance. I want to thank Catherine Clark, Coordinator of the NTID cochlear implant team, for her willingness to share her vast repertoire of knowledge and resources. To all of the above mentioned, without your review and feedback throughout the creation process, this booklet would remain far from being complete.

A special thanks to Dr. Gerald Bateman, MSSE Program Director, and Nora Shannon, MSSE Coordinator of Student Teaching…two wonderful role-models for teachers. Your persistence in making sure I didn't "skip out early" and constant support since day one has been invaluable. Thanks for helping me to arrive at this new beginning with a Masters degree in my hand. Thank you to Nora for being of help in the final editing stage.

Also a special vote of thanks to Marty Nelson-Nasca, Director of the Monroe BOCES #1 Program for Deaf and Hard-of-Hearing students. Thanks for all your effort to help me collect information from those that will benefit most from this booklet; Teachers of the Deaf themselves. Because of your help, their feedback guided me along the design process with a clear focus on what was going to be most practical and helpful for the teacher on the "front line". To those teachers and audiologists who provided this feedback…countless thank-you's.

Cover photos courtesy of Cochlear Americas, Advanced Bionics, and Med-El

Table of Contents

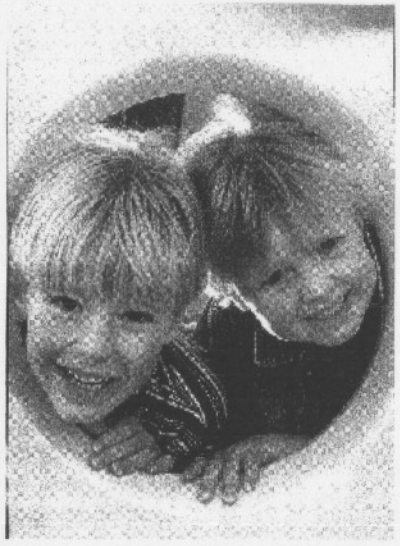


Photo courtesy of Med-El

The Purpose of this Booklet

Like a stampede, the cochlear implant (CI) has taken the worlds of deaf and hard-of-hearing persons by storm. From its inception in the mid 1980's, some have embraced the technology as a miracle cure, while others have thought of it as cultural genocide. Yet, today, many would argue that the implant has come and is here to stay.

There are many teachers with students using implants who feel inadequately prepared to deal with this technology. You might be one of them. If you are, this booklet is for you…keep reading! This book will provide you with skills and expertise related to working with your student. My goal in providing you this resource is threefold:

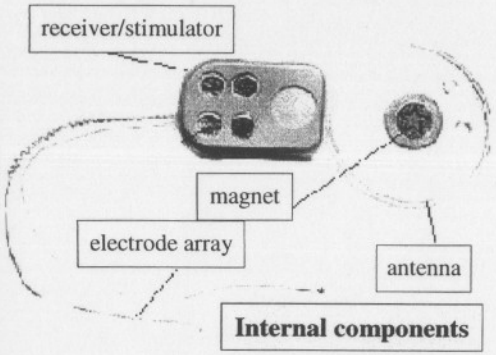
1.) To enable you to become a teacher that can help your student become a *successful* (i.e. auditory and speech skill development) and *independent* implant user;
2.) To prepare you to be an effective consultant to and partner with parents, teachers, audiologists, speech-language therapists (SLPs), and other colleagues in your immediate school environment; and
3.) To guide you to other resources that will assist you in finding answers to questions not included in this booklet.

As a teacher myself, I believe it is our professional responsibility to meet the needs of our students to the best of our abilities. If you have a student using an implant, this booklet is a great start (and a great resource guide to keep returning to). Recognizing the time constraints of a teacher, I have attempted to pull together a wide breadth of information from multiple sources in an easy-to-read, easy-to-find format. After reading this booklet, I hope you agree.

Tom Ohl
The Author

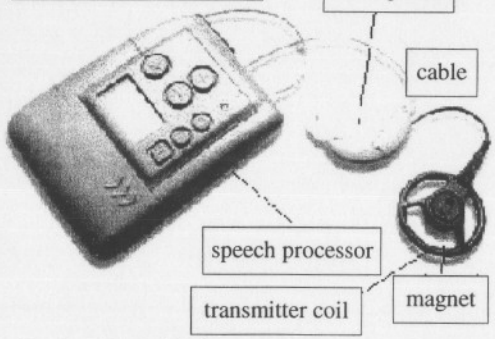
What is a Cochlear Implant

This section provides you with an explanation of what an implant is by giving you a simple definition of the device and its use. It also describes the parts of an implant and how it works.

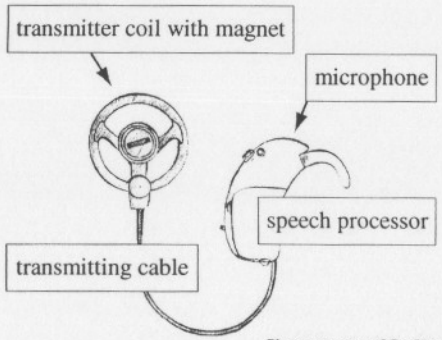


Internal components

Body-worn external



BTE external



Photos courtesy of Cochlear Americas

A simple definition

A cochlear implant, or CI, is a battery-powered electronic device. It is designed to improve a child's ability to detect sound and therefore, the potential for greater speech understanding when benefit from hearing aids alone is negligible. One part is surgically implanted into the cochlea and surface of the skull while another is worn externally like a hearing aid.

Unlike a hearing aid that amplifies sounds going to the ear, a CI bypasses the damaged ear hair cells by sending a programmed electrical signal to the remaining healthy nerves in the cochlea. This stimulates the auditory nerve directly, which can then relay the information to the part of the brain that is responsible for hearing.

Parts of a typical implant

Although CI systems can and do differ (manufacturers offer various numbers of channels, electrodes, and speech coding strategies), all implants share the same basic components.

Internal Components

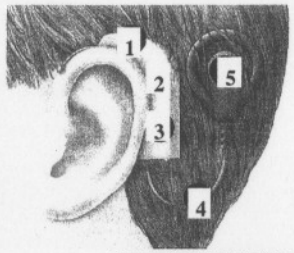
1. a magnet, antenna, and receiver/stimulator
2. an electrode array

External components

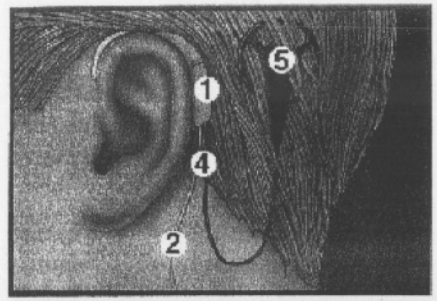
3. a microphone
4. a speech processor
5. a transmitting cable
6. a transmitter coil with magnet

The external portion may be worn entirely on the head (behind-the-ear / BTE) or in combination with a body-worn component.

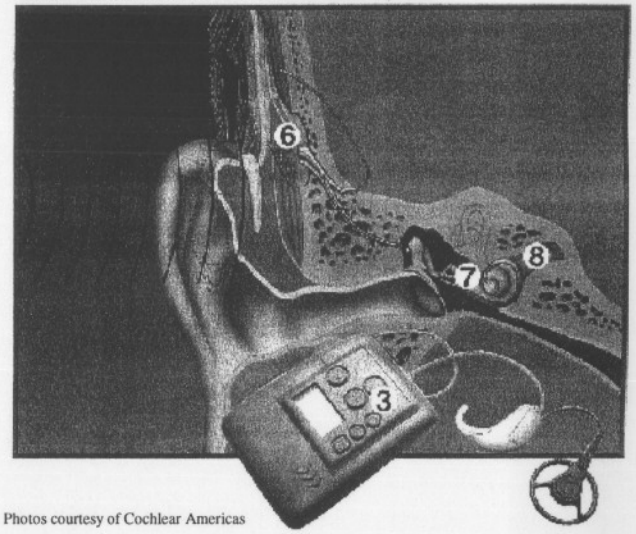
How it works



BTE Processor



Body-worn Processor



Photos courtesy of Cochlear Americas

1. Sound is picked up by a directional microphone.
2. Sound is sent from the microphone to the speech processor.
3. The processor, programmed with a speech coding strategy*, analyzes, selects and digitizes useful parts of the sound (i.e. for speech and music) into a coded electrical signal.
4. Coded electrical signal is sent through the transmitting cable to the transmitting coil.
5. Transmitter sends code across the skin to the internal receiver/stimulator.
6. Receiver/stimulator converts code into electrical pulses. These pulses are targeted to stimulate specific electrodes in a specific manner.
7. Electrical pulses are sent to the electrode array to stimulate the remaining healthy nerve fibers.
8. The electrical signals are sent via the auditory nerve to the brain. There, the electrical signals will be interpreted as sounds, producing a hearing sensation (within microseconds of the microphone picking up the sound).

**A "speech coding strategy" refers to the technique the speech processor uses to translate the pitch, loudness and timing of sound into the signals the implant sends to the cochlea.*

Why I Need to Know About Implants

You have a student using a CI in your classroom. Because you have the student's best interest at heart, you want to know. However, what if you don't have a CI student? This section offers additional rationale "to know" for *all* teachers by addressing increasing candidacy requirements and numbers, the cochlear implant controversy, and the teacher's role in identifying potential candidates.

Expanding FDA criteria

Expanding criteria	1990	Today
Minimum AGE	2 yrs.	12 months
ONSET of hearing loss	pre-linguistic	pre- & post-linguistic
DEGREE of permanent sensorineural hearing loss	profound (≥100dB)	≥2 yrs. severe-profound (≥70dB) <2 yrs. profound (≥90dB)
CHILD speech scores	0% best aided condition	Lack of auditory progress ≤ 30% on age appropriate tests

Numbers rising

The number of implant recipients has steadily increased over the past four years. Today, there are over 60,000 recipients. Manufacturers expect this growth to increase 20-25% yearly.

This growth can be attributed primarily to expanding FDA criteria for potential candidates due to advances in technology. Since 1990 when children (of age two) were allowed to be implanted for the first time, subsequent changes have lowered the age of implantation to 18 and 12 months in 1998 and 2000, respectively. Today's FDA criteria also includes children with severe to profound hearing loss (previously only those with profound loss were allowed). Though children represent a small percentage of the severe-profound population, child hearing-impairment is thought to be under-reported.

The growth may also be due to changes in disability law. Severe-profoundly deaf children who might have previously been placed in a residential deaf school are now being mainstreamed under the Least Restrictive Environment provision of the Individuals with Disabilities Education Act (IDEA). As a result, more deaf children are finding themselves in Hearing school environments where the benefit of better speech and auditory skill development is much more advantageous.

Which of my students might be a CI candidate?* *(Should answer "yes" to all)*

Do they have severe-profound sensorineural hearing loss (nerve deafness) in both ears?
Are they failing to progress in the development of auditory skills?
Are they receiving little or no benefit from traditional amplification (hearing aids, FM)?
Are they healthy (no contraindications)?
Is the student and family highly motivated and do they have appropriate expectations?
Is appropriate aural/oral support stimulation available in the school?

**Candidacy needs to be determined collaboratively (teacher, audiologist, SLP, etc.)*

The historical controversy

Throughout the history of deaf education, there has been a strong pull from two viewpoints—the medical view and the cultural view. The former views deafness as being abnormal and needing to be fixed, with the goal of integrating deaf children into a Hearing society. The latter views deafness as simply being different and needing to be explored, with the goal of helping deaf children find a pride and identity within a unique Deaf culture.

Since the FDA approved the Nucleus 22-channel cochlear implant for surgical implantation in children aged 2 through 17 on June 27, 1990, the controversy has continued.

In a 1993 position paper, the National Association of the Deaf (NAD) deplored the decision as being unsound on scientific, procedural, and ethical grounds. While making no reference to parents' rights to choose, they claimed implants to be highly experimental with little evidence of benefit and little concern over the future quality of life of the deaf child physically, emotionally, and socially. Understandably, the Deaf community saw the implant as a threat to the preservation of their culture.

Those outside Deaf culture with a medical perspective perceived the implant as a miracle device able to restore the hearing of deaf children. Their hopes were placed on the device's potential to help a deaf child develop spoken language. Many of them failed to agree with the NAD's position, arguing it was internally contradictory to maintain that cochlear implants do not work and yet work so well they will eliminate deafness.

The controversy today

Through time, the controversy has evolved. Most dramatically, the NAD stated in its 2000 position paper that it "recognizes the rights of parents to make informed choices for their deaf and hard-of-hearing children, respects their choice to use cochlear implants…, and strongly supports the development of the whole child and of language and literacy." This change reflected a willingness of the Deaf community to give up some "ownership" of deaf children and begin investigating the implant within the context of Deaf culture.

However, the 2000 paper also stated "many within the medical profession continue to view deafness essentially as a disability and abnormality and believe that deaf and hard-of-hearing individuals need to be fixed by cochlear implants. This pathological view must be challenged and corrected by greater exposure to and interaction with well-adjusted successful deaf and hard-of-hearing individuals." Thus, it is apparent that the Deaf community has retained its sense of pride and identity.

Many people have strong opinions about CIs. You, too, may have an opinion. Regardless of your stance, though, knowledge that such a controversy exists is invaluable. Allow it to spur you on to investigate and search out the facts. Use this booklet to prepare yourself to be a useful resource to parents and other teachers when they approach you as the "expert". Be ready.

FDA Approved Cochlear Implants

This section focuses on helping you to recognize the CI device your student may wear and provide you with a description of each that is useful to you as a teacher. Be aware that older students may be wearing an older model not detailed here.

FDA approved devices

Today, there are three cochlear implant manufacturers providing implant devices in the United States.

- **Cochlear Americas (Nucleus devices)**
- **Advanced Bionics (Clarion devices)**
- **Med-El Corp. (COMBI 40+ devices)**

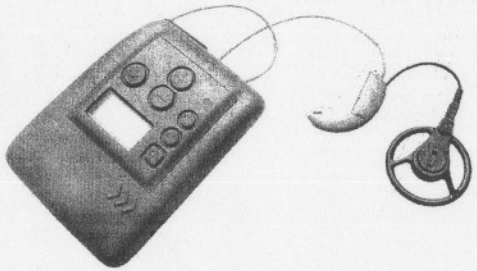
To date, Nucleus devices have been implanted in children and adults more than the other two combined.

Nucleus Devices

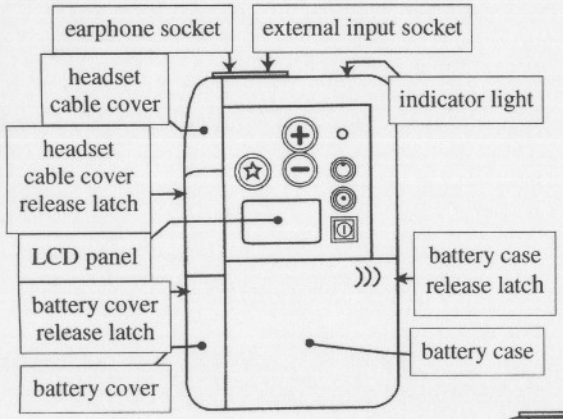
SPrint BODY WORN PROCESSOR

- 4 user selectable programs
- unique feature. . . lock to prevent access to controls

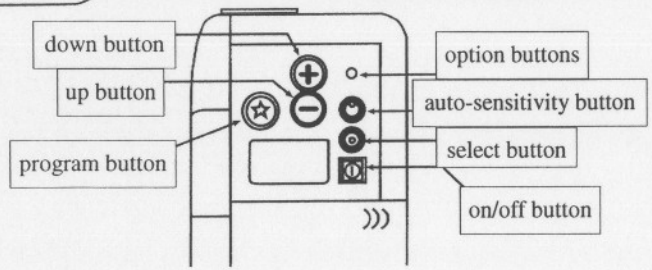
Photos courtesy of Cochlear Americas



Parts Labeled



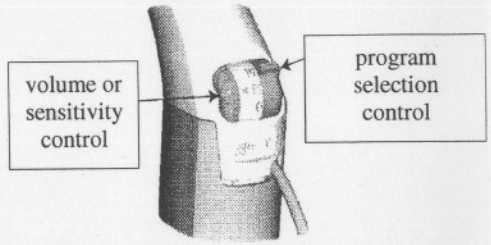
Control Buttons

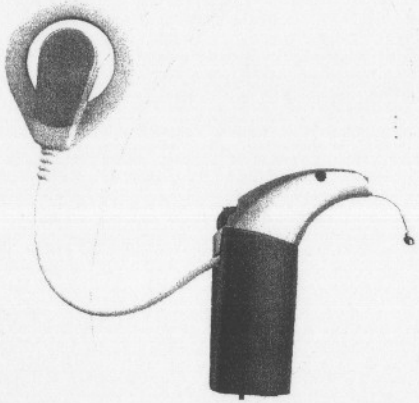


ESPrit 3G BTE PROCESSOR

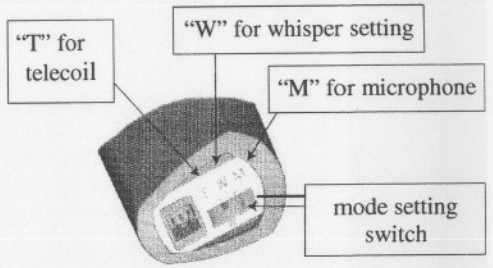
- 2 user selectable programs
- unique features. . . built-in telecoil, whisper setting for hearing soft speech

Top Controls

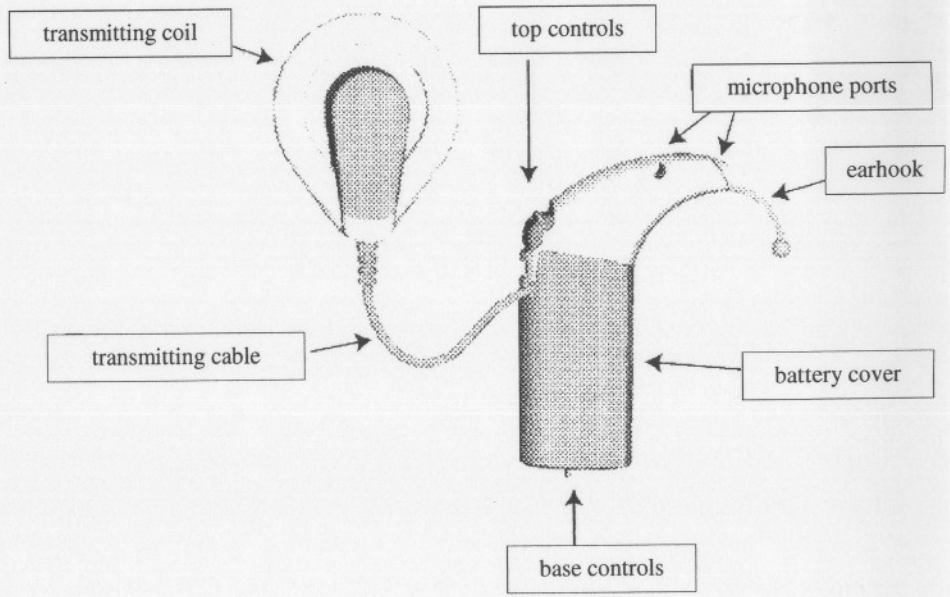




Base Controls



Parts labeled



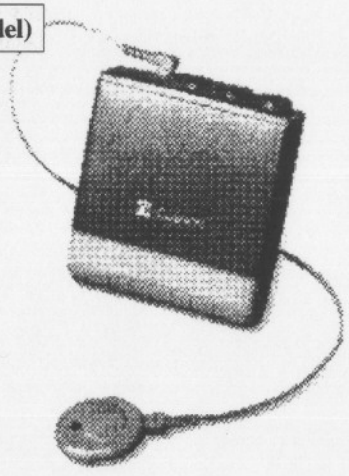
Clarion Devices

Photos courtesy of Advanced Bionics

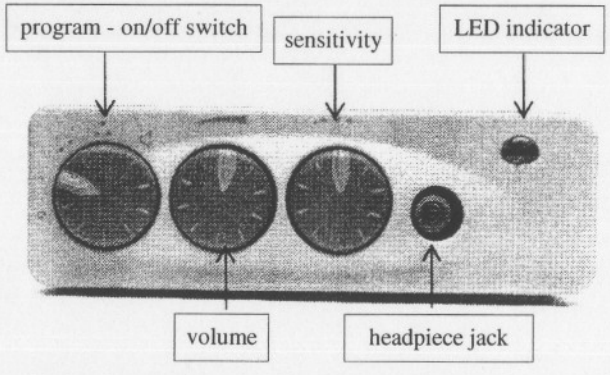
CII Bionic Ear BODY WORN PROCESSORS
- 3 user selectable programs for S-Series
- 3 user selectable programs for Platinum Series

S-Series (older model)

Platinum Series (newer model)

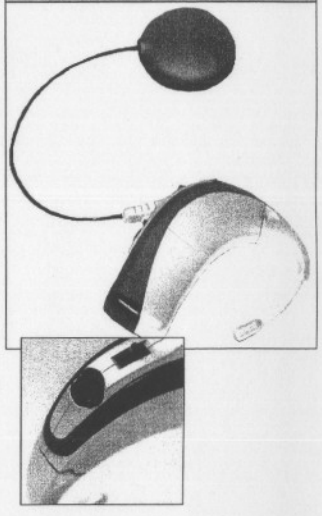


Controls

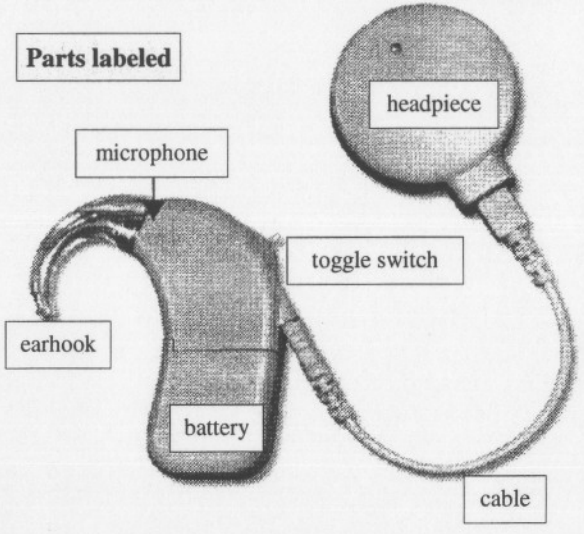


CII BTE PROCESSOR
- 3 user selectable programs
- unique feature. . . allows hook-up to "FireFly" (a real-time ear hook that lights up when BTE is operating)

CII HiRes Auria BTE PROCESSOR (New as of June 2003)
- unique feature. . . uses a full sound processing strategy that selects and digitizes *all* of the sound signal, not just parts of it.



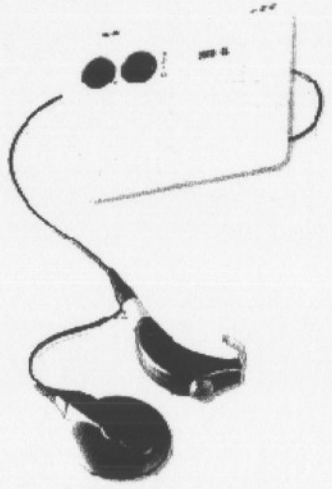
Parts labeled



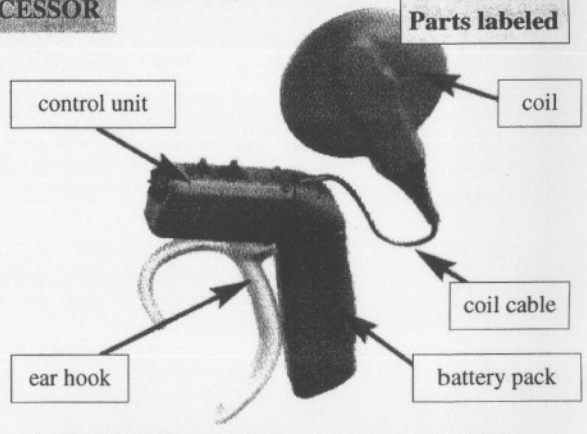
COMBI 40+ Devices

CIS PRO+ BODY WORN PROCESSOR

Photos courtesy of Med-El



Parts labeled



TEMPO+ BTE PROCESSOR
- 3 user selectable programs
- unique feature. . . multiple wearing options

The Implantation Process

As the student's teacher, you are not expected to do the actual implanting of the device. However, you may be interacting with the student as he or she goes through this process. It is important that you be able to understand what is occurring in their life outside of school (and why they are missing days of school). This section gives a brief outline of what your student may be experiencing or may have experienced in the past.

The surgery

Cochlear implant surgery is performed under general anesthesia, in an outpatient setting, and lasts for about 3-4 hours. Most children go home the same day or spend no more than one night in the hospital.

During the surgery, the electrode array is threaded into the inner ear and the receiver coil is placed in the drilled out bone crevasse behind the ear. A pressure bandage is placed around the incision. Generally, the incision needs 3-5 weeks to heal before the child can have the external parts "fitted". However, within that time, most will feel well enough to resume normal activities and return to school.

When your student returns to your classroom, they will most likely no longer be wearing a pressure bandage. However, the area of the child's head where the external implant will later be placed will be shaved. Some teachers may choose to prepare the other students for the child's return. Others may allow the implant child to explain for him or herself when they return. Regardless of your approach, it is important you do not allow the implant student to be made fun of or feel rejected by his or her peers.

Hook-up day

This is the point at which the student is "fitted" with the external implant parts (the transmitter and processor). It usually takes place 4-6 weeks after the surgery at the implant center. Before this point, the child is unable to hear with the implant. Commonly, the event is referred to as the child's "hook-up day" or "initial stimulation session".

On hook-up day, the MAPing process occurs in which the child's initial "listening" program (or more if the processor allows for multiple programs) is programmed into the child's speech processor. This program is designed to provide your student optimal access to the speech spectrum.

Be aware that many children continue use of conventional amplification (i.e. hearing aid) in the un-implanted ear.

What is a MAP?

A MAP is the "listening program" stored in the memory of the student's speech processor. It is created from a computer and special program that measures the child's responses to quiet and louder sounds. More specifically, it determines the "threshold" (T-level) and the "comfort level" (C-level) for each electrode that has been implanted in the child's cochlea.

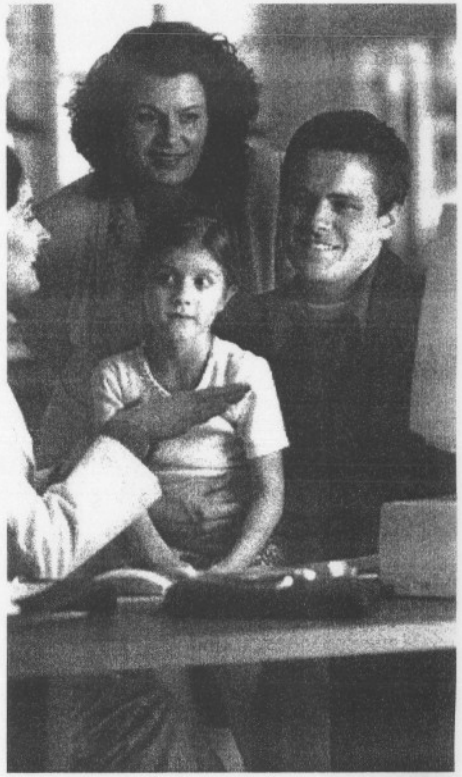


Photo courtesy of Oticon

Follow-up after hook-up

After the initial "hook-up day", your student will go back for periodic visits to have their speech processor fine-tuned. The repeated visits are necessary because it takes time for the hearing nerve to adapt to the new electrical signals from the electrodes and for the brain to learn how to interpret these signals. As time goes on and the MAP becomes more finely tuned, the number of adjustments needed will decrease.

Be aware that you may be asked by the audiologist or parent to monitor which program/MAP the child is able to hear best with.

Working with the Student After Hookup

Immediately after a student receives an implant, there are two main concerns. First, is the implant device and MAP working? Second, how is the child understanding the new sounds they hear? This section gives teachers helpful information to be used when addressing these questions.

Ling Six-Sound Speech Test

1. Sit at level of the student 3 ft. away.
2. Cover your mouth with your hand.
3. Say in a normal tone of voice…
   ah (as in father) **oo** (as in moon)
   ee (as in key) **sh** (as in shoe)
   s (as in sock) **m** (as in mommy)
   Be sure not to get into a rhythm and each day, present in random order.
4. Have student respond in a manner that matches your goal.
   If detection, raise hand;
   If recognition, imitate sound.

Remember:

- First focus on student detecting the sounds, then recognizing them.
- High frequency sounds /s, sh/ are new to the student and initially may be more difficult to recognize.
- Regardless of whether the student detects or recognizes the sound correctly, give encouragement. All students need to know they are doing a good job listening.
- Perform the test at both 3 and 6 feet.

Monitoring the CI & MAP

Most importantly, a *daily* routine to ensure the device is working properly should be established. This daily functional check should involve having the child listen and respond to his or her name and detecting or identifying a set of speech sounds using the Ling six sound speech test.

Assume the student will respond to sound in a structured environment. If they do not, or their listening ability decreases suddenly, the device should be checked immediately. Document any changes that persist or worsen over a period of more than a week. Your notes will be valuable information for the implant center, school audiologist, SLP, and parents should they contact you.

During the first three to six months, it is *natural* for the child using an implant to need changes in their MAP. Be sure your student knows it is a natural and positive result of them becoming more accustomed to sound.

Because many students will be unfamiliar with the device or unable to provide feedback regarding sound quality, it will be your responsibility to monitor the student to identify when MAP changes might be necessary.

Abridged from A Teacher's Guide…(2002), p.15

Observational clues that a MAP change may be necessary:

- Emergence of persistent disruptive or of with drawn behavior.
- Diminished response to environmental sounds.
- Change in frequency of vocalization, voice quality and/or vocal intensity.
- Slow reduction in distance listening.
- Student consistently alters sensitivity setting by more than 2 numeric levels. (higher or lower)
- Increased requests for repetition or use "What?" or "Huh?"
- "Slushy" production of formerly mastered speech sounds.
- Omission or confusion of consonants that were formerly present or discriminable.
- Neutralized vowel production.
- Presence of physical symptoms such as an eye or facial twitch.

Making sense of new sound

From school bells and screeching chairs to speech at conversational levels, every sound your student hears through the implant system is new. You must realize that the sound they are hearing is different from what they heard with their hearing aids. It is your job to help them make sense of this "new" sound. Here's how you can help. . .

1. *Don't expect initial recognition*

It is possible the child will need to hear a sound or word many times before recognizing it. Don't be afraid to repeat it for them. Be prepared to use your teacher-gifted patience!

2. *Draw their attention to sound*

Hearing babies naturally learn to associate sounds with objects in the environment quickly. Your student will learn to do the same as they begin to hear more and more sound. Encourage this learning process by prompting them to attend to sounds in your classroom environment such as the bell ringing or someone knocking at the door. This sound-object association will become a vital foundation.

3. *Give a chance to listen*

Even when your student does not respond, assume they can hear and just need time to process. If a sign, visual, or gestural clue is necessary for understanding, do so but always end by repeating your question or comment in auditory form. This is called making an "auditory sandwich" (auditory first, then visual aid, end with auditory reinforcement).

Photo courtesy of Med-El

4. *Create a listening environment*

Make a concerted effort to limit background noise (i.e. use Assistive Listening Devices, close doors and windows) and be willing to adjust your teaching style. When lecturing, you may need to slow down, repeat often, and be mindful of how you position and emphasize words.

5. *Allow early success*

For many deaf children, hearing has been a frustrating challenge frequently leading to failure. As a result, they tend not to trust their hearing. You can help your student succeed by limiting the amount and complexity of the information you provide them. Use familiar acoustically-contrasting items, and move from simple to more complex structures as when trying to increase their acoustic memory.

6. *Provide context*

Providing meaning is essential when integrating sounds. Making your classroom context-rich could involve the establishment of daily routines or repeatedly focusing on key words during your instruction.

7. *Challenging & reasonable goals*

Just as with any student, goals are vital in providing a target at which to aim. Consider the child, the family's desires, and current research. Use this information to set auditory goals that will be challenging for the child, yet not overwhelming. As you move toward the target, periodically check back to make sure established skills are maintained.

Abridged from A Teacher's Guide…(2002), p.14

Using Assistive Listening Devices (ALDs)

This section explains why ALDs are beneficial and the ways in which they can interface with a cochlear implant. It also provides information on selecting an appropriate ALD, offers considerations for when using a personal FM with a CI, and encourages you to consider the school environment as a whole.

Why use ALDs

Some teachers may assume that ALDs are unnecessary given the fact that the child has an implant. However, the speech processor will still choose to send the loudest signal to the ear. Therefore, even with the best technology, children who are hard-of-hearing or deaf will hear best when the sound source is within 3 feet and there is no competing noise.

The purpose of an ALD is to increase the signal-to-noise ratio by reducing distance, sound distortion and room reverberation. The child benefits by being less distracted and being better able to concentrate on the teacher.

When to wear an ALD

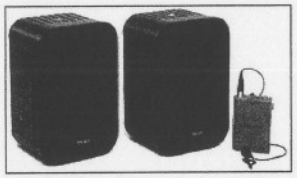
For newly implanted students, hold off on fitting an ALD. Do so even if they had been using an ALD system prior to getting the implant. They first need experience hearing sound with their implant alone. This is extremely important for very young children who often show minimal responses during the early implant stages. The FM can be easily coupled to the CI after you and the audiologist are confident in the responses of the student wearing only his implant.

ALDs and implants

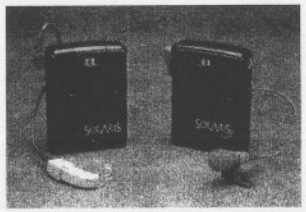
The most common ALD/implant pairings used in schools are:

- an **induction neck loop** used with a built-in or attachable **telecoil** on a BTE implant; (*Nucleus 3G BTEs have built-in telecoils);*

- a **sound-field FM speaker unit**, usually placed on the child's desk, used with a body-worn or BTE implant; and



- a **personal direct-connect FM receiver** that inputs directly into the speech processor of a body-worn or BTE implant. *(There are two FM systems capable of directly attaching to an implant: the AVR Sonovation LogiCom Ci and the Phonak MicroLink).*



Troubleshooting ALD systems:

Check for:

- Weak battery
- Defective cords, buttons or antennas
- Microphone plugged in incorrectly
- Channel interference

Choosing an ALD

In deciding which ALD is appropriate for your student, there are several things you need to keep in mind:

- Sound-field FMs (e.g. desktop speakers) are recommended for very young children unable to report a malfunction or students with limited implant experience because teachers can easily monitor the signal.
- Personal FMs are recommended for students in middle and high school who change classrooms or participate in after-school activities since they offer the greatest portability.
- Sound-field FMs are easiest, requiring no extra body-worn equipment.
- Telecoil/induction loop systems require an extra body-worn receiver.
- Personal FMs can be cumbersome because both the body-worn FM receiver and body-worn speech processor may be required. Though capable of attaching to a BTE implant, the child would still need to wear a body-worn FM receiver and patch cord. (*In Fall 2003, BTE CIs will be compatible with the wireless MicroLink FM receiver.)*
- Personal FMs provide optimal signal-to-noise ratio.
- Personal FMs can be used in group discussions. However, because the coupling* renders the implant's ear-level microphone inactive, the teachers transmitter mic would need to be passed around or a FM conference mic placed on the table.

** "Coupling" refers to the use of a cochlear implant with any other listening device that has the capability of attaching directly. Such devices include FMs, CD players, personal radios, tape recorders, televisions, and computers. The patch cord necessary to connect the CI to a particular device will depend upon the device and the brand of implant. Because of this, it is important that you communicate with the educational audiologist to obtain the proper cords through the manufacturer.*

Considerations when coupling

- Modifications to the FM may be necessary so the student can monitor their vocal productions. (particularly for MSPs or Spectra processors w/ serial #s below 34000)
- Certain FM channels are preferred for use with students who use CIs as they are less susceptible to electromagnetic interference from fluorescent lighting, computers, etc.
- Interference is possible between the speech processor and FM receiver. Maximize the distance between the two units given the connecting cord and size of the student. If your student reports their FM has static or is buzzing: have child move to a different place; reposition FM receiver; move FM receiver away from speech processor; change FM channel; replace connecting cord from FM receiver to CI speech processor; or try using a shorter transmitting cable from the processor to the microphone.
- Being tied into the teacher's dialogue may be appropriate for teacher-directed activities, but less appropriate for independent or group activities. In small groups, the child may miss opportunities for incidental language learning if the teacher's voice is the primary signal and the teacher is talking to another group.

Abridged from A Teacher's Guide...(2002), p.18.19

ALDs in the school

Be mindful that your student may be one of many children using an ALD in your school. Address this issue with the entire school staff so that each classroom is on a different frequency and arrangements can be made for students who share activity areas (e.g. gym, computer lab). Encourage the establishment of a procedure for sending in broken equipment if one is not already in place at the beginning of the year.

Encouraging Independence

Being able to monitor and use one's implant without constant support is important. This section reviews what your student should know to be independent, provides detailed description of important do's & don'ts, and explains proper care of an implant.

Photo courtesy of Oticon

What they need to know

As a classroom teacher, you may only spend one year with your student. Even if you are a Teacher of the Deaf (TOD), students do graduate and move forward in their lives. Thus, it is your responsibility to encourage your student to become an independent cochlear implant user without your assistance. In order to do this, there is essential information your student will need to know. This includes:

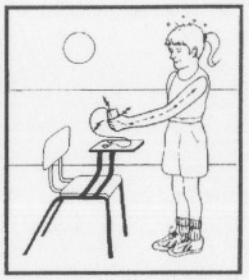
1. What are the parts of my implant?
2. How does my implant work?
3. What can I do and not do with my implant?
4. How should I take care of my implant?
5. What could go wrong with my implant? And what are the warning signs I should be looking for?
6. What should I do (& who should I contact) if my implant is not working? And is it something I can fix myself?

What information you share and when you share it will depend on the age, ability, progress and personality of your student. Be aware that some of this information may have already been given to them by the implant center or their parents. However, your review of the information with them may still be helpful. You may also want to communicate with his or her parents to find out if there is any additional information they think is beneficial for their child to know regarding the device.

Static electricity

Because an implant is an electronic device, proper precautions should be taken against static electricity. Static electricity poses a danger to the speech processor, with the potential of destroying the processor's MAP(s). The following pictures illustrate some DO's and DON'Ts that you and your student should be mindful of.

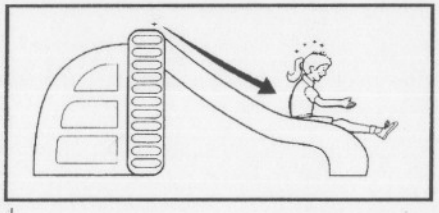
Don't pick up your implant equipment without first discharging possible static electricity build-up by touching the surface that the device is resting on. In this picture, the student should have touched the metal desk first.



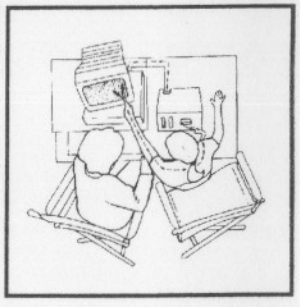
Don't let anyone touch your implant without first touching your shoulder or arm. They may have built up static electricity simply from touching a metal doorknob or walking across a carpeted floor. Similarly, you should always touch a person or object before your implant touches them.

Do wear your implant cables next to your skin under all clothing so that static electricity will most likely go through your body to the ground. If you wear them outside, they may brush up against or be drawn to objects with high levels of static electricity, such as a TV or computer.

Do remove your speech processor and headset whenever you are around or before using play equipment likely to build up high levels of static electricity (plastic slides, tubes and ball pits, trampolines). If you're not sure, a tip-off might be noticing your student's fine hair standing on end!



Don't touch a computer screen while wearing your implant. It is possible to reduce static electricity around computers by placing an anti-static shield over the computer monitor screen and anti-static mats under the chair, keyboard, and mouse.



Photos from Teacher's Guide…(1999)
Do's and Don'ts abridged from A Teacher's Guide…(2002), p.72-75

Moisture

Moisture, including perspiration, is damaging to an implant. Therefore, precautions need to be taken. They include:

- Take off the implant before swimming or showering/bathing.
- Remove or cover the implant with a hat or hood during inclement weather.
- If processor is worn on the front of the body, be careful not to splash water on the implant when using a drinking fountain or washing your hands/face.
- Use Dri-Aid to store the device.

Photo courtesy of Oticon

Photo courtesy of Med-El

If the implant does get wet, take the following steps:

1. Remove the batteries.
2. If dropped in dirty water, rinse briefly with running drinking water.
3. Shake off as much water as possible.
4. Place processor in dry pack and notify the parent.

If the processor is not working the next day, contact the school audiologist or implant center.

Abridged from A Teacher's Guide...(2002), p.22

Physical activity

Even with the risk of moisture, the child should *not* have to stop all physical activity such as running. Most children actually wear their implants for PE class. However, go to the parents for input regarding its use in PE class as some children may be more susceptible to head injuries and cochlear damage.

While no extraordinary precautions need to be taken, protective headgear should be used when it is available (for activities such as biking, rollerblading and football). Children who play soccer should be cautioned against "heading" the ball.

Care of the implant

Using the system

- It is *not* necessary to completely discharge the rechargeable battery prior to recharging it. However, make sure you have used the batteries for more than 2-3 hours.
- Turn the processor off prior to changing the batteries, replacing cords, or plugging an ALD into the external jack.
- Keep extra cords and batteries in a predetermined secure place.
- Attach an ear mold (the kind used with BTE hearing aids) or a mic lock to the microphone to help it stay in place. This is particularly important for children who are naturally more active.
- Make an identification tag for the processor.
- If the outer magnet falls off often, contact the parent or audiologist.

Cleaning the system

- Do not get sand or dirt into any part of the implant. If this happens, shake out as much dirt or sand as possible.
- For regular external cleaning, wipe gently with a cloth dampened with mild detergent. But before using, make sure the device is completely dry. Regular cleaning will prevent dirt build-up.
- Clean the device pouch using cold water and mild detergent.

Storing the System

- For long-term storage, remove the batteries. *Do not* store the batteries in the refrigerator. Putting a cold battery in a warm processor could cause problems with moisture condensation.
- For long term storage, keep the microphone and processor (without the batteries) in a DRI-AID kit to reduce problems caused by moisture. A modified DRI-AID kit can be made by putting desiccant inside an air tight plastic container or even a zip-lock bag.
- When not being used for a brief period of time, place the implant in the storage case or DRI-AID kit (particularly in humid climates) labeled with the child's name.

Abridged from A Teacher's Guide...(2002), p.22 and Parents' Guide (2002), p.25,26

The Classroom Environment

The device alone will not make the child hear better. This section suggests modifications you can make in your classroom to help.

The challenge

What makes a classroom so challenging for a child using a cochlear implant? Simply put…acoustics. Your student is no different from a child who uses hearing aids in that their sensory aids are often not enough to overcome the adverse and competing noise found in the learning environment. Thus, you must be willing to modify your room to improve the implant child's ability to hear, ultimately increasing his ability to communicate and interact with his or her peers and teacher.

Providing visual support

Because students do gain some benefit from speechreading:

- Have the child sit where they can see your face and others' faces if in discussion.
- Position yourself so that light sources are not behind you.
- Use overheads and handouts as opposed to the black- or white-board.
- For those who use an interpreter, place interpreter near teacher and in a visible location.

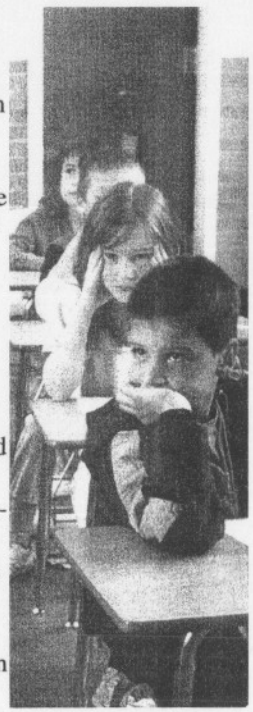


Photo courtesy of Oticon

Improving acoustics

Several modifications can be made to reduce noise and heighten your student's ability to hear in the classroom:

- Close the classroom door.
- Carpet floors and hang curtains on windows. If carpeting is not available, table and chair feet can be padded using old tennis balls.
- Arrange seating so that student is away from the doorway, fans, overhead projectors, and heater/ac.
- Because implant microphones are directional, the student should always sit facing the sound source with the signal directed toward the implanted side of the head.
- Put acoustic tiles on hard, reflective walls. If you can't convince your school to do this, you can hang cloth, paper, or possibly a corkboard instead.
- If desktops lift open, you can use cork or felt to reduce noise from them opening and closing.

Consult the school audiologist or SLP to evaluate the physical arrangement with you.

Modifying instruction

Your instructional approach may need to change slightly. Be sure to gain the student's attention before initiating a discussion or giving instructions. Also, before beginning conversation, state the topic first. Periodically check to make sure the student understands by asking him or her to repeat instructions or concepts.

In the initial stages, some teachers have found setting up a "buddy system", where a classmate repeats instructions, to be beneficial. Establishing a buddy note-taker and/or tape-recording lectures for later review may also be helpful.

Auditory & Speech (Re)habilitation

Knowledge of and expertise in auditory and speech skill development and training is absolutely essential for any teacher working with a student using a CI. Without it, there is little you can do to help your student benefit from his or her implant. This section gives you the basics of what you need to know, what you need to think about, and what you need to do.

What you need to know

To help your student obtain optimal benefit for auditory and speech development from his or her device, there is some information you will need to know before planning and implementing a (re)habilitation program:

- Date of hearing loss onset (pre– or post– lingually deafened).
- Date of initial amplification (how long have they been a CI user?).
- Student's level of skill with the implant at the current point in time.
- The child's post-implant audiogram (see page 26 for a model audiogram of the average hearing benefit you can expect from an implant).
- The child's current MAP program(s) (make sure you are made aware of any MAP changes by the MAPping audiologist).

Most, if not all, of this information you will be able to retrieve from the student's audiologist and SLP.

Guiding principles

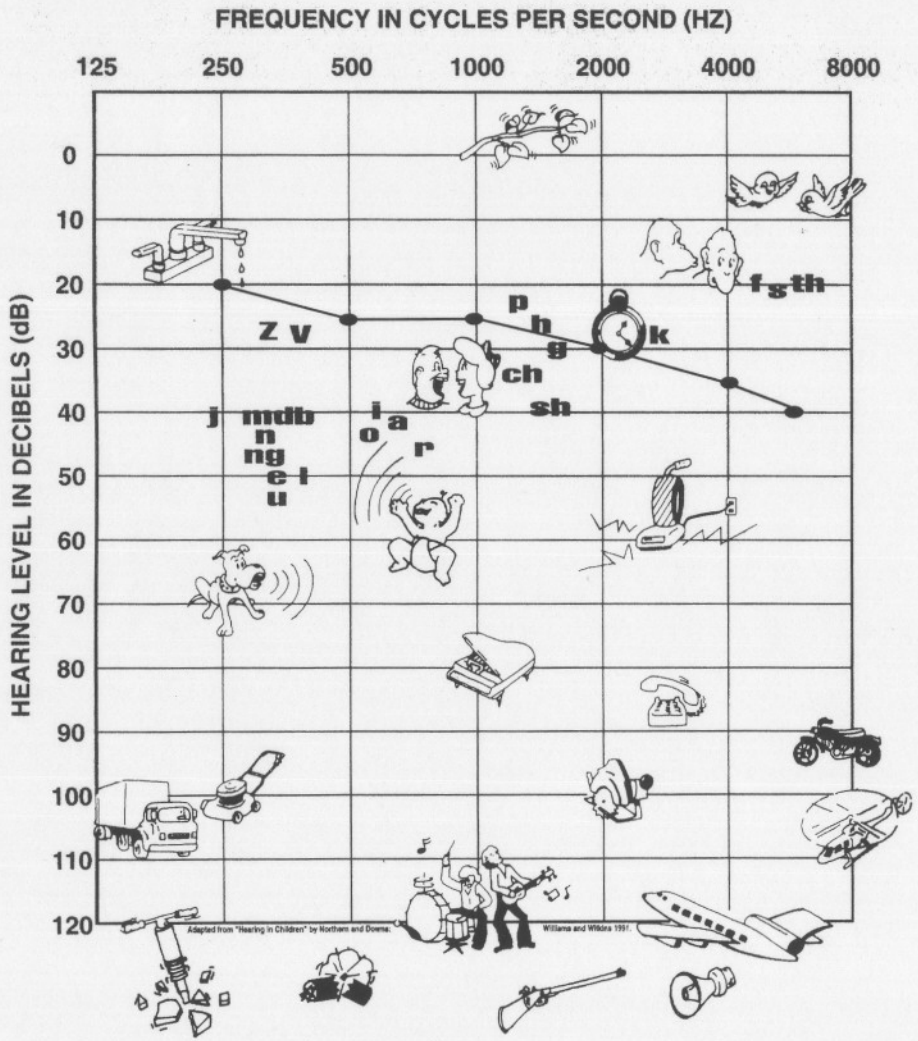
When planning and developing a program with the speech-language pathologist and audiologist, you need to reflect upon the rationale for the recommendations you are about to implement. These principles are contained in the box to the right.

The 8 Guiding Principles

1. The development of speech perception and production abilities is the primary goal of implantation. Therefore, meaningful speech should be used as the input for listening tasks.
2. The goal of any listening activity includes the activation of the speech/auditory feedback loop (linking listening and speaking). Therefore, listening activities should always provide an opportunity for a productive response.
3. Children need to understand both what they are supposed to do and the language used to tell them what to do for successful auditory work to occur.
4. In the past, CIs primarily provided all children with suprasegmental speech cues (i.e. rhythm, intonation, stress). Today, more have gained access to segmental information (i.e. individual speech sounds). Regardless, the ability to benefit is sharpened with specific listening practice.
5. If classroom listening is one of the goals of auditory practice, then it follows that the content of the auditory lesson be suggested by the child's classroom curriculum.
6. Listening practice should be provided with a variety of input units: the phoneme (sound), word, phrase, sentence, and connected discourse.
7. There is a complex relationship between language and listening skills, and thus mastered listening skills must be practiced in increasingly complex linguistic environments.
8. Tasks at the phoneme level should be selected by the teacher based on student's speech production errors.

Abridged from Chute & Nevins (1996), p.107-116

The average hearing benefit gained from a cochlear implant



**Student is able to hear everything above threshold (below the plotted line on audiogram).*

Normal auditory dev't.

Given the fact that the prelingually-deafened child's hearing experience at the time of "hook-up" is equivalent to that of a newborn, you should expect the same skill development as that of a baby. While the student will need to accelerate through the following stages to "catch up" to their hearing peers, you should be able to observe the following natural progression. Use these stages to guide the expectations of your self, student, and child's parents, and the (re)habilitation program.

1. Auditory detection (awareness to sounds) *Target environmental sounds initially; Try to imitate the sound, slow the rate slightly, and exaggerate the intonation and pitch.*
2. Auditory imitation (matching vocal production to sound) *Focus on phoneme recognition and production.*
3. Auditory Integration (associating sounds with symbols or objects) *Aim at having the child select an object from a small set of easily differentiable items (e.g. "moo" for cow, "hop" for bunny).*
4. Auditory discrimination (distinguishing similar sounding words) *Help student make finer distinctions between consonants and vowels by using minimal pairs.*
5. Auditory Comprehension (understanding connected speech) *Common phrases and exaggerated intonation are a good starting point; Good sources are nursery rhymes & children's songs and stories because they are repetitive.*
6. Incidental Learning via Audition *Your goal should not be to teach the student every skill, but to target specific skills that can be generalized to different environments.*

Stages abridged from A Teacher's Guide...(2002), p.16

Immediate auditory goals to be implemented following hook-up

If the child:	*Then teaching objective should encourage:*
• Detects a wide range of speech signals in structured tasks.	• Responding to name. • Perceiving pattern contrasts (single syllable words vs. multi-syllable words and/or short phrases or sentences vs. long phrases or sentences).
• Discriminates different patterns of speech in structured situations (the largest percentage of children will begin at this level).	• Constant expansion of set of pattern contrasts. • Carryover of acquired skills demonstrated in structured setting in classroom. • Introduction to closed set listening tasks.
• Wears the processor but shows no auditory awareness.	• Alerting to the presence of speech sounds, especially the child's name. • Alerting to environmental sounds.
• Refuses to wear the device.	• Implementation of a wearing program. • Getting the device turned on as soon as possible and begin alerting to speech.

Reprinted from Chute & Nevins (1996), p.83

Choosing a program model

(Re)habilitation programs for implant children usually ground themselves upon one of three approaches: auditory-verbal, auditory-oral, or total communication. Which approach you choose will depend upon the child, parental choice, school placement, and preferred mode of communication prior to being implanted. While providing a description of each approach is beyond the scope of this booklet, it is important that you research and discuss with the child's audiologist and SLP before deciding.

Implementing the program

Regardless of the program model that is chosen, make a concerted effort to capitalize on the routines of your classroom and the content of the child's curriculum. The tasks you develop must challenge the child auditorily while, at the same time, not frustrate him or her linguistically. Encourage your student to fully participate in activities that make use of auditory comprehension.

Remember… in your lessons include:

- *Explanation and training of auditory memory* through remembering names, association practice, and attentiveness.
- Activities related to *rhyme, inflection, intonation, and accent.*
- Exercises using *context clues.*
- *Practice in vowel recognition* since they are the strongest voiced elements of speech .

Reprinted from Wayner

Photo courtesy of Oticon

Bridging sign to speech

For children who relied on Sign before being implanted, the auditory and speech process may be more difficult. However, research has shown that Sign can be used positively as a bridge. Often, these children already have a firm foundation in language. Therefore, use Sign in your instruction to improve the student's understanding.

If your student previously relied on Sign, remember:

- Signing is not enough….the child must hear the language in order to integrate it into his spoken language lexicon.
- Always voice when you are signing.
- If you are signing/talking, you must expect the same of your student.
- Your student will not develop and improve mean length of utterance and speech intelligibility without being expected to talk.

As you help your student transition to oral communication, use these tips:

- Use the child's Sign to help identify sounds, words, and phrases.
- Provide activities auditorily as often as possible.
- When first reducing signs, use familiar phrases and directions & cover for key words.
- Use the "auditory sandwich" technique (speech—sign—speech).

Abridged from Egan

Habits to develop with a Signer

- Use speech to get their attention.
- Expect speech with a point or tap.
- Continually introduce new vocab.
- Speak in full sentences.
- Use figurative language (idioms, nonsense words, expressions).
- Expect child to learn via hearing.

Developing Partnerships

A child's success with a cochlear implant relies on the success of implementing a multidisciplinary approach. This section provides information about the different roles of cochlear implant team members and reflection on the value of including parents.

Collaboration

Without a doubt, the information in this booklet alone can be quite overwhelming. When you think about having to put it into practice, it may become even more so. Fortunately, you don't have to do it alone. There are professionals willing to assist you as you work with your student in the classroom. These people include: the educational and implant center audiologists and the SLP.

The educational audiologist is probably the most important as they can be used as a liaison to the other audiologists involved and a consultant who is familiar with aural rehab and maximizing audition. The SLP can offer a wealth of knowledge and guidance in developing the speech and language (re)habilitation program for your student. Finally, the implant center audiologist can provide you with information about the implant itself along with any changes that are made over time (e.g. MAP). The CI surgeon typically has little involvement after the child is cleared post-op.

In return, your responsibility is to inform your colleagues of any obvious changes in the child's listening behavior or speech production. Also, as the teacher, take the initiative to get the team working together and communicating often.

Photos courtesy of Med-El

Involving parents

The motivation of the student's family significantly contributes to the success of the student using an implant. Given your knowledge, you will need to make sure their expectations are appropriate and that they are supporting free time use of the CI unless it must otherwise be taken off.

Encourage them to continue the same auditory habits being developed in your classroom at home (and vice versa). In doing so, periodically inform them of what is occurring in school and how their child is doing. For children who are too young to be responsible for the implant's hardware, a system of regular communication, such as a daily journal, should be established between the child's home and school.

Most importantly, always reassure them that their input and participation is valuable, acknowledging the fact that they know their child best.

Quick Tips

*Perform your **daily check** to make sure the cochlear implant is working properly. This should include:*

checking the batteries;
checking the microphone of the CI (need a special adaptor); and
a functional check (responding to name and Ling six sound test).

*Have your student **look at you visually and listen** as much as possible.*

*Use a screener for **testing the student's speech perception** ability periodically during activities.*

*Use a **multidisciplinary approach**. Develop a good relationship with the school audiologist and SLP.*

Communicate with audiologist constantly for information about your student's MAP and listening skills, & how you can promote their auditory development (brainstorm creative activities).
Meet with your student's speech-language therapist to develop creative language activities appropriate for their ability.

*Make listening activities **FUN!***

*Be particularly mindful of **touching a student's shoulder BEFORE you touch the implant** to avoid damage caused by static electricity.*

***Do** face the student when talking.*
***Do** keep eye contact when speaking.*
***Do** speak clearly.*
***Do** repeat a word or sentence exactly. If still not understood, then choose alternative phrases to express your thoughts.*
***Do** monitor environmental noise.*
***Do** monitor environmental light.*

***Don't** turn away from the student's view when speaking.*
***Don't** over-exaggerate your speech*
***Don't** attempt to talk over loud back ground noise. Wait for the noise to stop or move to a quieter place.*
***Don't** shout when speaking.*
***Don't** speak with objects in or in front of your mouth.*

Do's and Don'ts reprinted from Rawlinson (2000)

Frequently Asked Questions

Abridged from Issues & Answers...(2002)

Will the components of the implant ever need to be changed?

Implant devices are designed to last a lifetime. However, as with any man-made device, there is some risk of failure. Almost all who have experienced a device failure are successfully re-implanted. The cost of re-implantation may be covered by warranty or service contracts, which vary depending on manufacturer.

Will current implant children be able to take advantage of future technological advances?

The near future holds many possibilities in cochlear implant innovation. Very likely, implants will eventually be fully implantable. Bilateral implants & hybrid devices that combine hearing aids and implants are also foreseeable in the future. Whether current implant children will be able to take advantage of these advancements will depend on the type of implant they have. Most likely, surgery will be required.

However, users of cochlear implants are constantly taking advantage of external and program upgrades. Manufacturers are constantly enhancing speech coding strategies and speech processors. In these cases, new implantation or surgery is not required.

How much does an implant cost?

Costs for the pre-implant evaluation, the implant system, surgery, and post-surgical fitting and training are generally $50,000 to $70,000. However, most private insurance policies and/or health plans will provide full or partial coverage. Medicare may also provide coverage.

What are the limitations of CIs?

Cochlear implants cannot help all severe-profoundly deaf children. They also alone can not ensure satisfactory use and benefit. Many factors are involved in the implant child obtaining optimum benefit, and thus their "success" is difficult to predict.

The teacher, though, can play a significant role in helping the CI child learn how to use the new sound information the implant provides. If you are willing to be patient and develop auditory skill expertise, you will be able to help the child overcome some of these limitations.

What are the risks associated with an implant and the surgery?

In addition to the standard risks associated with surgical anesthesia, there can be surgical complications or infection of the incision area. Other risks include: failure of the auditory nerve to respond; complete loss of residual hearing; need to avoid MRIs; damage of the speech processor program by static electricity; distorted sound sensation caused by metal detectors, theft detection systems, or digital cell phones; equipment problems; and damage of the internal receiver by head trauma.

Glossary

Assistive listening device (ALD)
A device that, when used together with hearing aids or a cochlear implant, enhances the signal-to-noise ratio and the student's ability to hear in difficult listening situations.

Audiogram
The product of a hearing test. It shows how loud a given tone needs to be in order for the implanted child to be able to hear it. Everything above threshold level is able to be heard.

Auditory learning
Developing speech and language skills through the use of residual hearing in naturalistic situations.

Auditory training
Listening exercises often occurring in drill and practice activities.

BTE (Behind-the-Ear)
Cochlear implant that sits behind the ear.

Cochlea
The inner ear where the electrode array is positioned.

Comfort level (C-level)
The highest electrical stimulation level that does not produce an uncomfortable loudness sensation for the child.

Comprehension
The ability to understand sound.

Coupling
The use of a cochlear implant with any other listening device that has the capability of attaching directly. Such devices include FMs, CD players, personal radios, tape recorders, televisions, and computers.

Detection
The ability to hear that a sound is present.

Discrimination
The ability to hear that one sound is the same or different from another.

Dynamic range
The number of units between the threshold and comfort levels.

Discourse
Connected sentences which may include a set of directions, a selection from a story or conversation.

FM system
A type of ALD often used to minimize interference from background noise and improve the signal-to-noise ratio in the classroom. Both sound-field and personal direct-connect FM systems require the teacher to wear a microphone/transmitter.

Habilitation
Instructional activities designed for the initial teaching of particular skills (i.e., audition, speech, language).

Identification (or Recognition)
The ability to label a stimulus heard.

Imitation
The ability to match one's own vocal productions with sound that is heard.

a MAP
The "listening program" stored in the memory of the speech processor.

Minimal pair
Two words that differ in a single distinctive feature or constituent (e.g. *bat* and *pat*)

Ossification
The bony growth within the cochlea, usually due to meningitis, which blocks the cochlea and prevents full insertion of the electrode array.

Prelinguistically-deafened
Became deaf at birth or an early age before little exposure to spoken language.

Postlinguistically-deafened
Became deaf at an older age after years of being exposed to spoken language.

Rehabilitation
Instructional activities designed for the reteaching of particular skills (i.e. audition, speech, language).

Sensitivity control
Control on CI that adjusts which sounds are heard (i.e. higher intensity sounds such as nearby speech vs. distant speech and environmental sounds)

Sensorineural hearing loss
Hearing loss caused by damage in the inner ear (cochlea).

Signal-to-noise ratio
The loudness of the sound signal as compared to the loudness of the background noise in the listening environment. The higher the ratio, the better the student will be able to hear.

Speech coding strategy
How a speech processor translates the pitch, loudness, and timing of sound into electrical signals that are sent to the cochlea. They include SPEAK, n of m, ACE, CIS, & MPS.

Speech perception
The ability to understand speech through listening only.

Speechreading
Visually scanning the face and especially the lips of the speaker to understand a spoken message.

Threshold level (T-level)
The minimum level of electrical stimulation required at each electrode for the child to first hear a sound.

Volume control
Control on CI that adjusts loudness of the sound signal.

References

Articles/Books (*go to your local library to retrieve*)

Bayard, S. (2003). Mainstream Success: Cochlear implants and ALDs are allowing our youth with hearing impairments to learn on a level playing field. *Advance for Audiologists*, March/April, 32-34. [article]

Nevins, M.E. & Chute P.M. (1996). Children with Cochlear Implants in Educational Settings. Singular Publishing Group, Inc. [book]

Niparko, J.K. (2001). Kids and Cochlear Implants: Getting Connected. Alexander Graham Bell Association for the Deaf and Hard of Hearing. ??? [article]

Teagle, H.F.B. & Moore, J.A. (2002). School-Based Services for Children With Cochlear Implants. *Language, Speech, and Hearing Services in Schools*, 33, 162-171. [article]

Trautwain, P. & Levi, A. (2000). FM Technology for Young Implantees: Audiologists serve vital role in interfacing ALDs with cochlear implants. Advance for Audiologists, July/August, 28, 30-31. [article]

Web Articles

Egan (n.a). *Maximizing the Hearing They Have: An Auditory-Verbal Approach*. Communications Coordinator at Clarke School/Pennsylvania. Powerpoint Presentation

Madell, J., Chute, P.M., & Kooper, R. (2002). *Making the Connection: FM Systems and Cochlear Implants*. American Speech-Language-Hearing Association. Retrieved Feb. 23, 2003, from http://www.professional.asha.org/news/020910b.cfm.

N.A. (2000). *The Ling Six-Sound Test*. John Tracy Clinic. Retrieved May 28, 2003, from http://www.jtc.org/family_services/correspondence/SpecialPapers/LingSixSounds.PDF.

NAD Cochlear Implant Committee (Oct. 6, 2000). NAD Position Statement on Cochlear Implants. Retrieved Dec. 13, 2002, from http://www.nad.org/infocenter/newsroom/positions/Cochlear Implants.html.

Rawlinson, S. (2000). *Serving Deaf Students Who Have Cochlear Implants*. NETAC Teacher Tipsheet Retrieved Feb. 23, 2003, from http://www.netac.rit.edu/downloads/TPSHT_Cochlear_Implants.pdf.

Thomas, M. & Rick, M. (2002). *Cochlear Implants Fact Sheet*. American Speech-Language-Hearing Association. Retrieved Feb. 23, 2003, from http://www.asha.org/press/cochlear_facts.cfm.

Wayner, D. (n.a.). *Learning to Hear Again: Cochlear Implant Audiologic Rehabilitation Guide for Adults*. Retrieved Dec. 17, 2002, from http://www.audiologyonline.com/audiology/newroot/ceus/showclass.asp?id=85.

Manufacturer Booklets (*contact appropriate manufacturer to retrieve*)

Advanced Bionics
Introduction to the Clarion CII Bionic Ear System (2002)
Device Fitting Manual (2001)

Cochlear Americas
A Guide for those considering a cochlear implant (2002)
Issues & Answers: The Nucleus 3 cochlear implant system (2002)
Making the Most of Your Nucleus Cochlear Implant (2001)
Parents' Guide: A Handbook for Parents Considering a Nucleus Implant. . . (2002)
A Teacher's Guide to Nucleus Cochlear Implant Systems (2002)
Teacher's Guide: The Nucleus Cochlear Implant System (1999)
User Manual SPrint (1998)
User Manual ESPrit (2001)

Med-El Corporation
COMBI 40+: The Next Generation Cochlear Implant System (n.a.)
Understanding Cochlear Implants (n.a.)

Cochlear Implant Manufacturers

Advanced Bionics Corporation
Mann Biomedical Park
25129 Rye Canyon Loop
Valencia, CA 91355
(800) 678-2575 in US and Canada
(800) 678-3575 TTY
www.advancedbionics.com
email: info@advancedbionics.com

MED-EL North America
2222 E NC Highway 54
Beta Building, Suite 180
Durham, NC 27713
(888) MED-EL CI (633-3524)
(919) 572-2222 Local/TDD
www.medel.com
email: office@medel.com

Cochlear Americas
400 Inverness Parkway
Suite 400
Englewood, CO 80112
(800) 523-5798
(800) 483-3123 TTY
www.cochlear.com

Resources

Suggested Reading / Books

The Parents' Guide to Cochlear Implants (2002)
P. Chute & M.E. Nevins; Gallaudet University Press

Questions Teachers Ask:
A Guide for the Mainstream Teacher with a Hearing Impaired Student (1999)
J. Winslow Otto to V. Kozak, Central Institute for the Deaf

Learning to Hear Again w/ a Cochlear Implant (1998)
D.S. Wayner & J.E. Abrahamson; Hear Again

Cochlear Implant Auditory Training Guidebook (1997)
D. Sindrey; Wordplay Publications

Cochlear Implants in Children: Ethics and Choices (2002)
J.B. Christenson & I.W. Leigh; Gallaudet University Press

Listening Games for Littles (1997)
D. Sindrey; Wordplay Publications

Children with Cochlear Implants in Educational Settings (1996)
M.E. Nevins & P.Chute; Singular Publishing Group

Classroom Goals—Guide for Optimizing Auditory Learning Skills (1996)
J. Firszt & R. Reeder; AG Bell Association of the Deaf

Suggested Websites

Auditory-Verbal International, Inc. (www.auditory-verbal.org) . . .
. . . A non-profit organization of professionals and parents whose principal objective is to promote listening and speaking as a way of life for children and adults who are deaf or hard of hearing; heightens awareness of the Auditory-Verbal approach through providing information, newsletters, international and regional conferences

AG Bell Association (www.agbell.org) . . .
. . . An organization of professionals, families and oral hearing impaired adults that supports auditory/oral communication and education; provides information, support groups, regional and national conferences. A catalog of published matereial for professionals working with hearing impaired children is available.

American Speech-Language-Hearing Association (www.asha.org) . . .
. . . A national professional organization that provides general information about hearing loss, hearing aids, assistive listening devices and audiology/speech-language pathology services.

Suggested Websites (cont'd.)

Cochlear Implant Central (http://www.geocities.com/cicentral/) . . .
. . . A site of information and resources about cochlear implants compiled by a graduate student implanted with a Clarion device in 2001.

Cochlear Implant Association, Inc. (www.cici.org) . . .
. . . A non-profit organization implant recipients, their families, professionals, and other individuals interested in cochlear implants; provides access to local support groups, advocacy for people with hearing loss, and internet and quarterly publications.

Council on Education of the Deaf (www.deafed.net) . . .
. . . An organization devoted to enhancing the learning environment of deaf and hard of hearing students by supporting the professional development and collaboration of teachers, and expanding the resources and opportunities of students. Mentor registration, discussion boards, job searches, and publications are offered.

Deafness Research Foundation (www.drf.org) . . .
. . . An organization committed to public education and research on hearing detection, prevention, and intervention; site contains several articles about and a helpful "Hearing Health Dictionary."

Hearing Exchange (www.HearingExchange.com) . . .
. . . An online community for the exchange of ideas and information on hearing loss.

The Listen-Up Web (www.listen-up.org) . . .
. . . A site with a great breadth of information on hearing impairment; includes a easy to locate site map with an entire section dedicated to cochlear implants.

National Association of the Deaf (www.nad.org) . . .
. . . The oldest and largest organization representing deaf and hard of hearing Americans; promotes public awareness of the Deaf community and provides opportunities for the certification of interpreters and ASL professionals.

National Campaign of Hearing Health (www.hearinghealth.net) . . .
. . . Sponsored by the Deafness Research Foundation, a campaign committed to putting hearing health on the national agenda by raising awareness, improve options for those living with hearing loss, and protecting the individuals that are at risk..

Nat'l Institution of Deafness & Other Comm. Disorders (www.nidcd.nih.gov) . . .
. . An organization set up with the goal of performing research to acquire new knowledge to help prevent, detect, diagnose, and treat disease and disability; a free publications section is included containing information on cochlear implants.

Where Do We Go From Here? (www.gohear.org) . . .
. . . Dedicated to being the best site for families of infants and children diagnosed with a hearing loss and the professionals that work with them.

Programs for Auditory Training & Rehabilitation

Reprinted from Teagle & Moore (2002)

Bringing Sound to Life: Principles & Practices of Cochlear Implant Rehabilitation
Author: M. Koch
Order from: York Press, P.O. Box 504
Timonium, MD 21094
Orders: (410) 560-1557
(800) 962-2763
www.yorkpress.com

The Developmental Approach to Successful Listening II (DASL), 2nd Ed. ($50 plus s+h)
Authors: G.G. Stout & J.V. Ert Windle
Order from: Resource Point, Inc.
61 Inverness Drive East, Suite 100
Englewood, CO 80112
(800) 523-5798
www.cochlearcorp.com
Phonetic Listening Word Lists
also available for use with DASL
($12.00 plus s+h)

CHATS: The Miami Cochlear Implant Auditory & tactile Skills Curriculum
Authors: K.C. Vergara & L.W. Miskiel
Order from: AG Bell Association
3417 Volta Place NW
Washington, DC 20007-2778
(202) 337-5220
www.agbell.org

Speech Perception Instructional Curriculum & Evaluation (SPICE)
Authors: J. Moog, J. Berdenstein, & L. Davidson
Order from: Central Institute for the Deaf
818 South Euclid Avenue
St. Louis, MO 6311
(314) 977-0000
www.cid.wustl.edu

Cochlear Implant Auditory Training Guidebook
Author: D. Sindrey
Order from: AG Bell Association
3417 Volta Place NW
Washington, DC 20007-2778
(202) 337-5220
www.agbell.org

Listening Games for Littles
Author: D. Sindrey
3417 Volta Place NW
Washington, DC 20007-2778
(202) 337-5220
www.agbell.org

Ski*HI Model: A Resource Manual for Family-Centered Home-Based Programming for Infants, Toddlers, and Preschool-Aged Children With Hearing Impairments
Author: S. Watkins & T. Clark
Order from: Hope Publishing, Inc.
1856 North 1200 east
North Logan, UT 84321
(435) 752-9533
www.hopepubl.com

Troubleshooting Guide

Reprinted from Troubleshooting the Cochlear Implant: General Guidelines From Including Children with Cochlear Implants: Guidelines for Teachers
Moore, C., Nesbitt, A., Peters, M., & Schery, T. (November 2002)

Maintenance of the cochlear implant device is a parental responsibility. However, you should be prepared to troubleshoot and perform minor maintenance (changing a cord or battery) from time to time. Because troubleshooting strategies will vary depending on device and the list of problems that could occur is lengthy, this guide addresses general guidelines for those problems you are most likely to encounter in your classroom. It is suggested that once you are aware of what cochlear implant your student wears, that you immediately contact the appropriate manufacturer to request a more detailed trouble shooting guide specific to your student's device (or borrow and copy from the parent).

Steps to troubleshoot:

- **Make sure the device is on.** If it is not, turn it on, or switch it to the proper program map. The parent or audiologist should show you this setting.
- **Make sure that the volume and sensitivity dials are at the proper setting.** The parent or audiologist needs to show you the specific setting for the child.
- **Check the transmitting coil.** Be sure the coil is securely fit on the head, and the magnet is in the proper place. Some implant systems have extra magnets or ones with adjustable strength. The parent or audiologist should adjust magnets since if they are too strong, they can cause pressure sores and if they are too weak, it may result in loss of the coil.
- **Check the battery.** As with hearing aids, implant batteries go out. Make sure the batteries are fresh and inserted properly, or change the battery if it is dead. The procedure will vary depending on the implant system: some use standard batteries, while others have rechargeable packs. Have extra batteries on hand. Do not interchange standard and rechargeable batteries.
- **Check the battery contacts.** Contacts could be corroded and therefore need to be cleaned. A cotton swab and a small amount of rubbing alcohol are useful for cleaning. DO NOT USE WATER.
- **Check all the cording.** This is an important item. Cords are the weakest part of the implant, with all the wear they get from the environment and the child's movement.
  - * Check all cording for cracks. These usually occur nearest to where the cord connects to the device.
  - * Change bad cording. You should keep a spare cord on hand.
- **Check the microphone for proper functioning.**
  - * Look for debris in the socket.
  - * Each implant device has a different way of indicating a functioning microphone. The manufacturer's guide will give you specifics (e.g. flashing light, beep).

If none of these is helping, contact your school or implant center audiologist and the child's parents. They will be able to troubleshoot further and/or arrange for repair.

***Supplies that should be on hand at school: extra batteries, extra cords, appropriate devices for checking system (e.g. wand, disc)**

National Technical Institute for the Deaf
Rochester Institute of Technology
52 Lomb Memorial Drive
Rochester, NY 14623-6604

This booklet was submitted
In partial fulfillment of the requirements
For the degree of
Master of Science in Secondary Education
Of Students who are Deaf or Hard of Hearing